September 2010 Climate Summary for Southwest Lower Michigan

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Overview

September 2010 was warmer than normal with highly variable precipitation across Southwest Lower Michigan. The month was marked by several windy days along with a few notable severe weather events, particularly on the 21st.

September 2010 Climate Summary for Southwest Lower Michigan

Table 1. Average temperature and precipitation / snowfall totals for September 2010 at the primary climate stations and averaged across Southwest Lower Michigan. Normals are computed from the 1971-2000 30-year average.

Location		Average Temperature (degrees F)	Precipitation (inches)	Snowfall (inches)
Grand Rapids	*Reported*	**62.7**	**2.80**	**0.0**
	Normal	**61.3**	**4.28**	**0.0**
	Departure	**+1.4**	**-1.48**	**0.0**
	Record Max Avg (year)	**69.0 (1931)**		
	Record Min Avg (year)	**56.2 (1918)**		
	Record Max (year)	**98 (1899)**	**11.85 (1986)**	**0.0**
	Record Min (year)	**27 (1991)**	**0.00 (1979)**	**0.0**
Lansing	*Reported*	**61.7**	**4.86**	**0.0**
	Normal	**60.5**	**3.50**	**0.0**
	Departure	**+ 1.2**	**+ 1.36**	**0.0**
	Record Max Avg (year)	**69.0 (1881)**		
	Record Min Avg (year)	**53.1 (1868)**		
	Record Max (year)	**99 (1894)**	**8.34 (1986)**	**0.0**
	Record Min (year)	**19 (1863)**	**0.00 (1979)**	**0.0**
Muskegon	*Reported*	**62.4**	**6.25**	**0.0**
	Normal	**60.5**	**3.52**	**0.0**
	Departure	**+ 1.9**	**+ 2.73**	**0.0**
	Record Max Avg (year)	**66.8 (1961)**		
	Record Min Avg (year)	**56.4(1918)**		
	Record Max (year)	**95 (1953,1954)**	**13.55 (1986)**	**0.0**
	Record Min (year)	**27 (1989,1991)**	**0.17 (1979)**	**0.0**

September 2010 Climate Summary for Southwest Lower Michigan

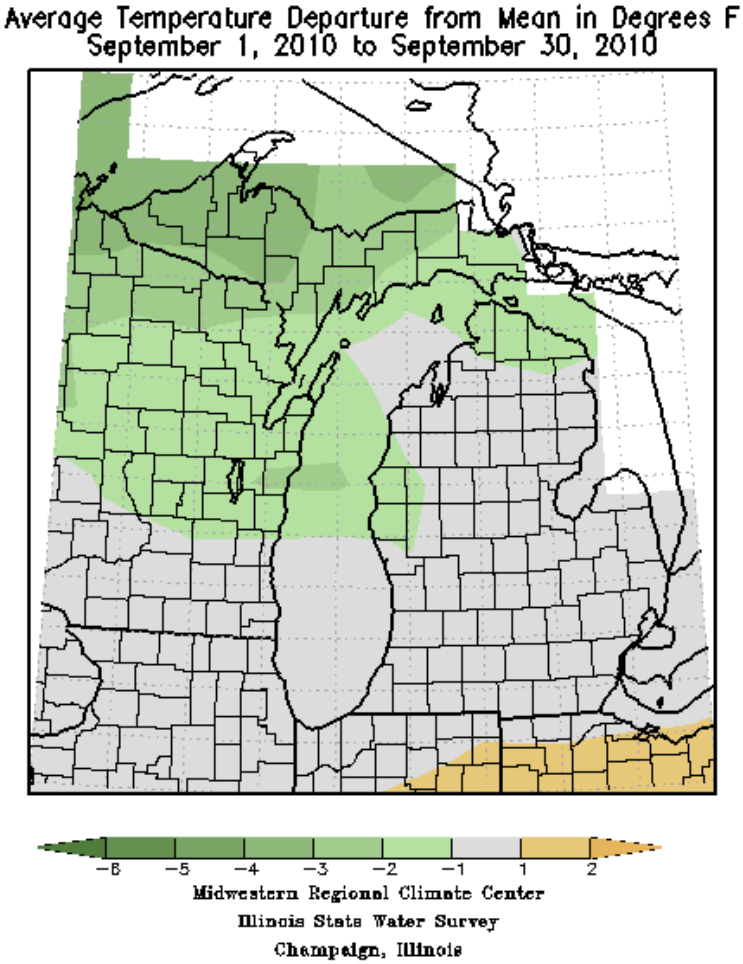

Figure 1. September 2010 average temperature departure from normal for the state of Michigan.

Temperatures:

Temperatures ranged from near normal to slightly above normal across Southwest Lower Michigan for the month of September 2010 (Figure 1). Although Figure 1 suggests near normal temperatures, all three climate sites were slightly above normal.

Classic fall temperature swings were common during September. The most notable swing occurred during the third week of the month, when temperatures soared into the upper 80s to near 90 degrees. Muskegon achieved a high of 85 degrees on the 23rd, setting a new daily record. Grand Rapids reached 88 degrees on the same day, while Lansing reached 87. Two days later, highs in many locations did not make it out of the 50s. Overall, the entire state of Michigan experienced the 37th coolest September out of the past 116 years according to the National Climatic Data Center (Figure 2). This may largely be due to cooler than normal conditions across northern Lower Michigan and the Upper Peninsula.

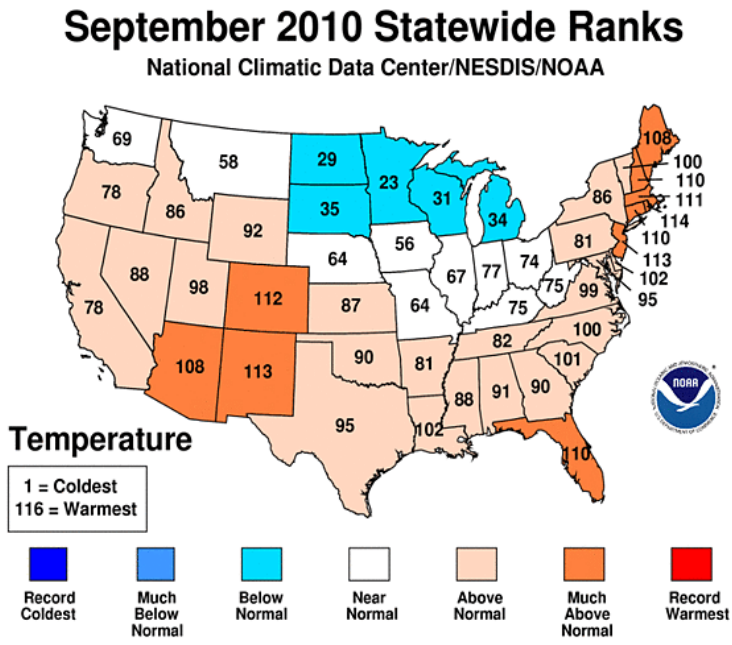

Figure 2. National Climate Data Center ranking state temperature ranking for September 2010.

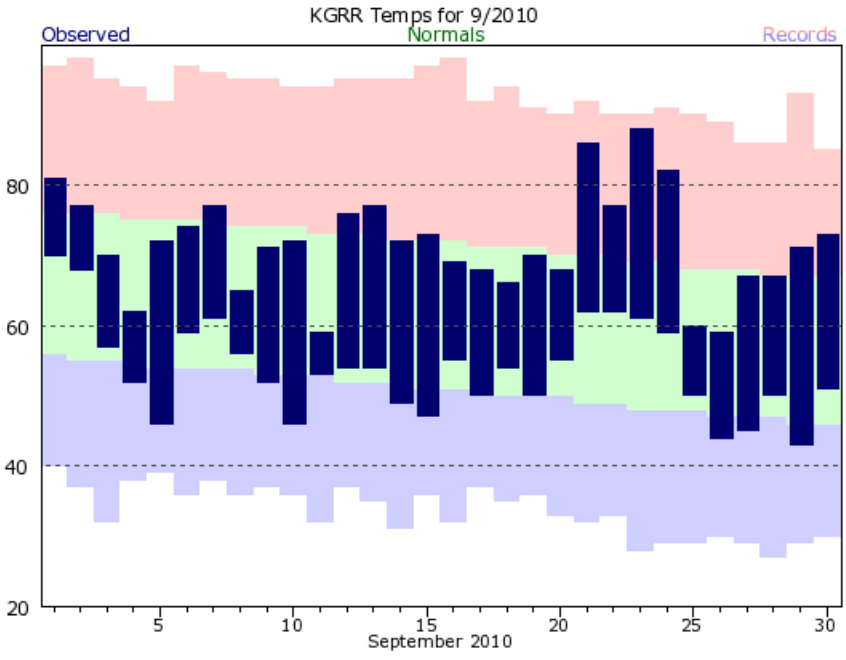

Figure 3. Observed temperatures at the Grand Rapids International Airport. Dark blue bars are the temperature range for each day. The green strip indicates the normal range of temperatures. Record high and low temperatures are indicated at the top of the pink area and the bottom of the blue area, respectively. Normals computed as in Figure 1.

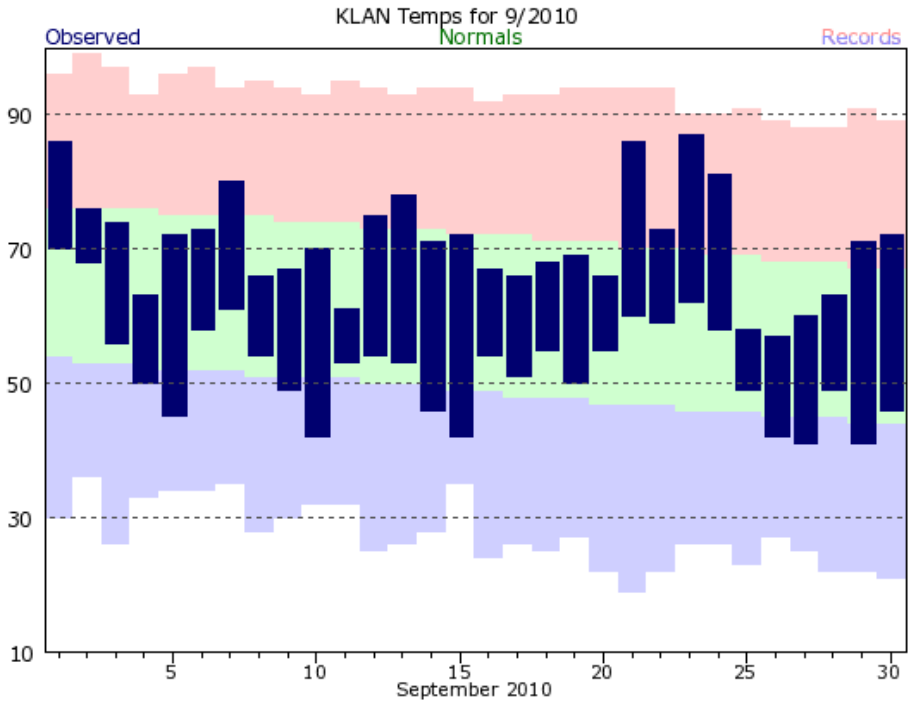

Figure 4. As in Figure 3, except for the Lansing/Capital City airport.

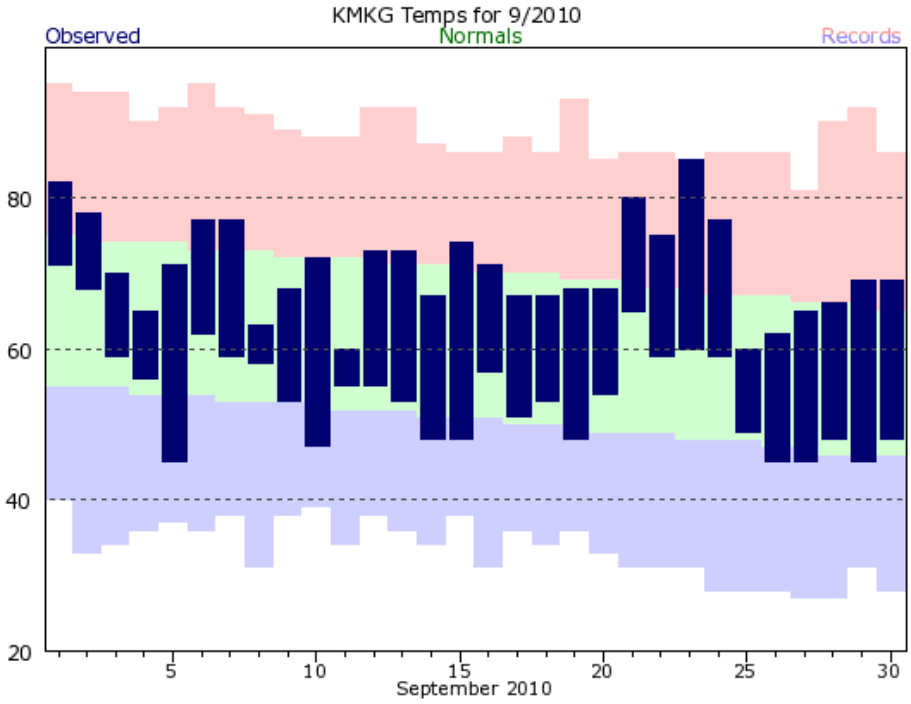

Figure 5. As in Figure 3, except for the Muskegon County airport.

Table 2. September 2010 temperature frequencies at the primary climate stations.

Number of days	Grand Rapids	Lansing	Muskegon
highs ≥ 90 (2010)	0	0	0
highs ≥ 90 (2009)	0	0	0
highs ≥ 90 (normal)	1.1	0.9	0.2
highs ≥ 90 (record)	7	9	4
year(s) of record	1897,1931	1874	1953
highs ≥ 80 (2010)	4	5	3
highs ≥ 80 (2009)	5	2	7
highs ≥ 80 (normal)	7.8	7.7	4.4
highs ≥ 80 (record)	17	19	14
year(s) of record	1908	1881	1947
lows ≥ 70 (2010)	1	1	1
lows ≥ 70 (2009)	0	0	0
lows ≥ 70 (normal)	0.6	0.2	0.5
lows ≥ 70 (record)	5	4	6
year(s) of record	1931,1985	1985	1985
lows ≥ 65 (2010)	2	2	3
lows ≥ 65 (2009)	0	0	0
lows ≥ 65 (normal)	2.5	1.8	2.6
lows ≥ 65 (record)	10 (1931,1961)	9 (1961)	12 (1961)
lows < 60 (2010)	24	25	25
lows < 60 (2009)	26	28	25
lows < 60 (normal)	23.7	25.1	23.2
Fewest lows < 60 (record)	15 (1947,1961)	15 (1947)	14 (1927,1931,1947)

September 2010 Climate Summary for Southwest Lower Michigan

Precipitation:

Precipitation was highly variable across Southwest Lower Michigan. Grand Rapids ended up well below normal while Lansing finished above normal and Muskegon well above normal (Table 1). There are two apparent reasons for the high totals at Lansing and Muskegon. Persistent heavy rains plagued the northern lakeshore region, particularly Muskegon County, late at night on September 2nd and into the early morning hours of September 3rd. This triggered a record deluge of rainfall totaling 3.34" for September 2nd at Muskegon. A similar situation occurred in Lansing on the 16th, leading to a record 2.28" of rain and flooding of streets and parking lots in urban areas. Overall, the state of Michigan ranked 16th wettest on record for September (equivalently, "101st driest"). This is attributable in part to widespread 6" to 9" rainfall totals that fell across the Upper Peninsula (Figure 10).

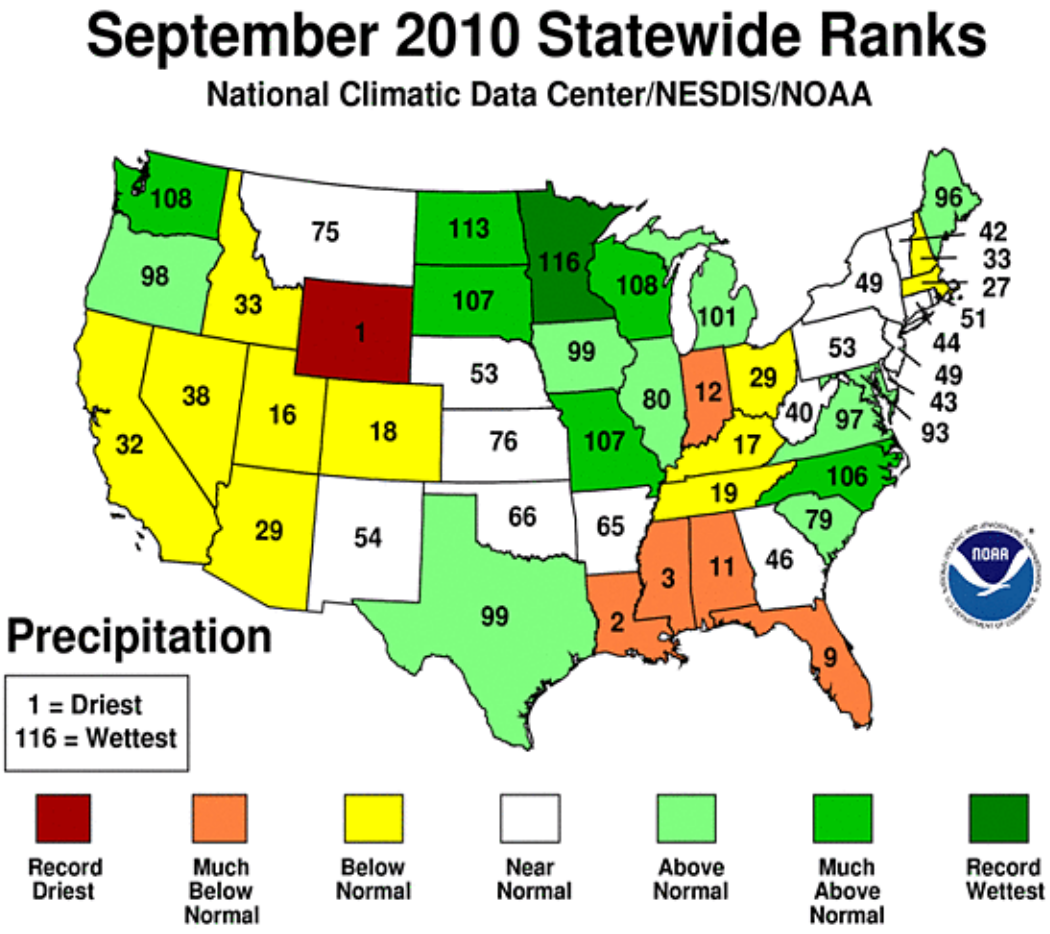

Figure 6. National Climate Data Center state precipitation ranking for September 2010.

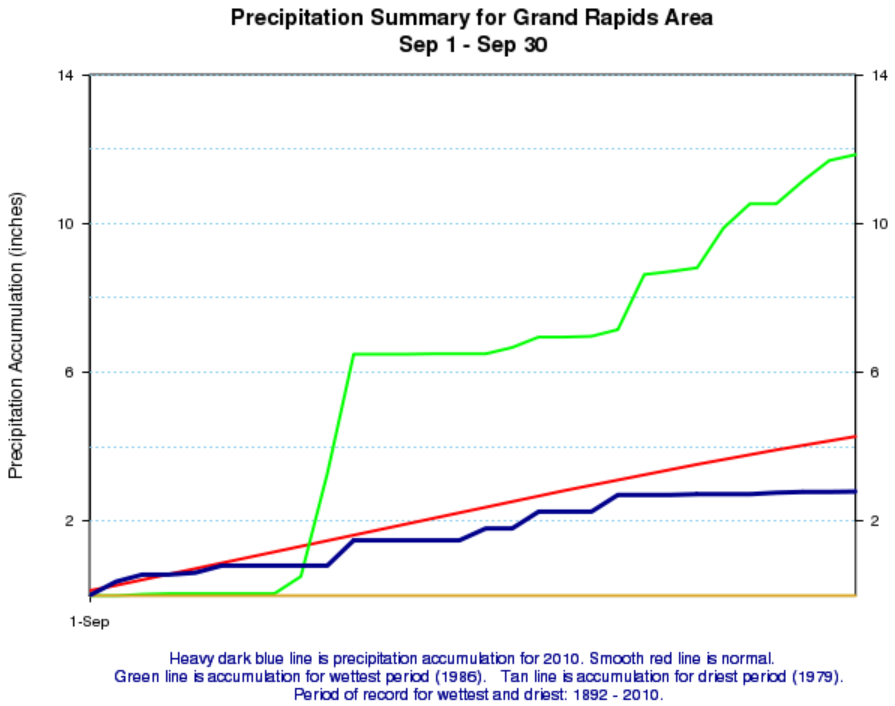

Figure 7. Daily precipitation in inches for September 2010 at the G.R. Ford International Airport.

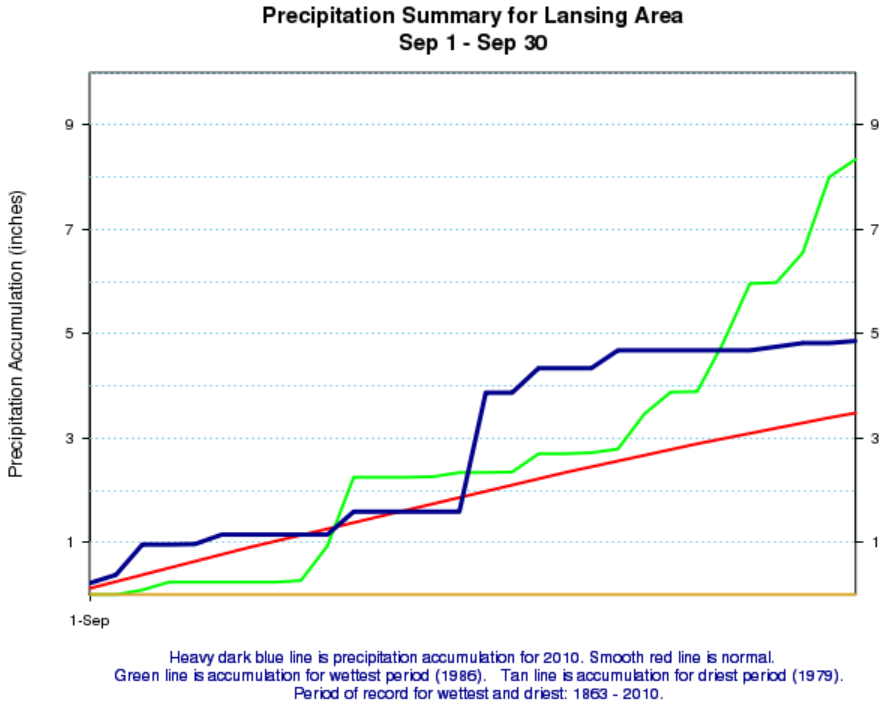

Figure 8. As in Figure 7, except for the Lansing Capital City Airport.

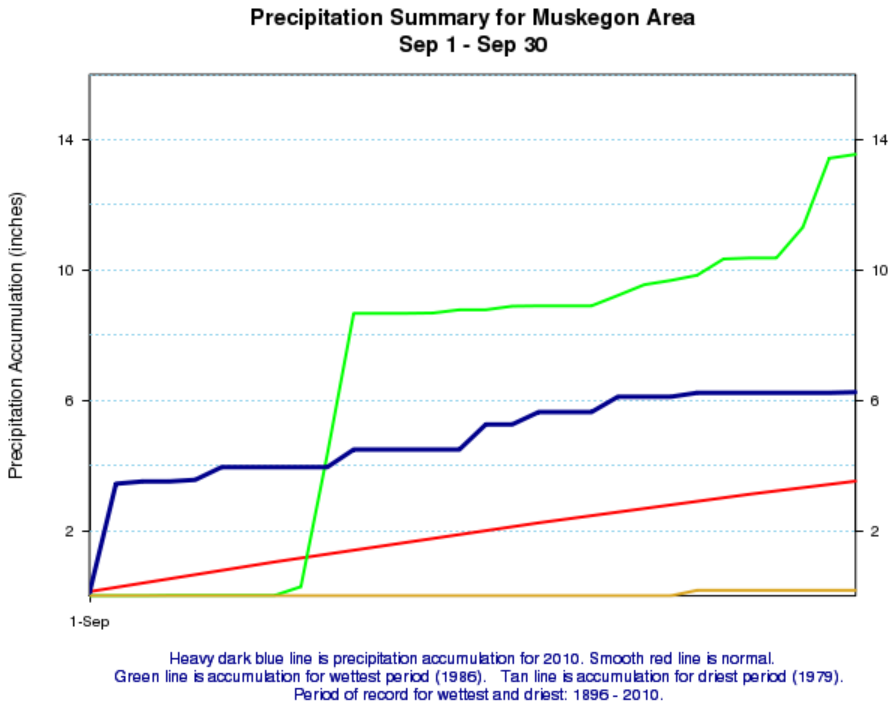

Figure 9. As in Figure 7, except for the Muskegon County Airport

The wettest part of Southwest Lower Michigan in September was a zone stretching from Muskegon County to Mason County, where 5 to 6 inches of rain fell (Figure 10). Elsewhere, 2 to 4 inch totals were commonplace. Rainfall anomalies ranged from around an inch below normal to around an inch above normal across Southwest Lower Michigan (Figure 11). Again, the rainfall event on September 2nd and 3rd helped play an important role in northwestern portions of the region receiving above normal precipitation. Locations across far southern Lower Michigan received less precipitation.

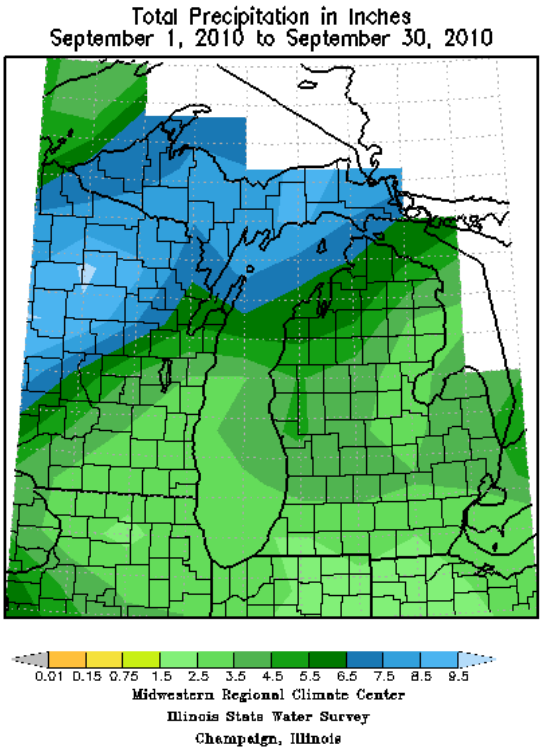

Figure 10. The total precipitation for Michigan during September 2010.

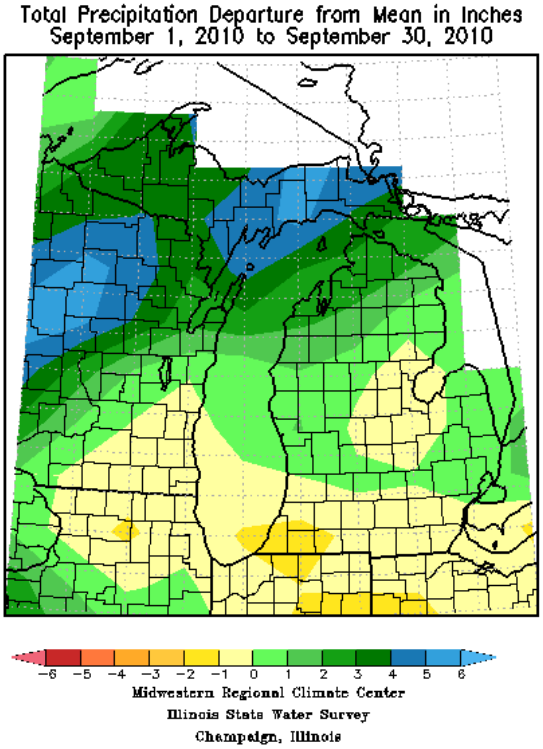

Figure 11. Precipitation departure from normal for Michigan during September 2010.

September 2010 Climate Summary for Southwest Lower Michigan

Severe Storms:

More severe weather events were reported this September than any other September going back to 1986. The total came to 51 events, besting the previous recent records of 31 set in 1997 and 2001. In addition, there were 2 severe weather episodes, defined as 3 or more severe weather events within a 6 hour period. Severe thunderstorms on the 21st contributed to most of those reports (see event summary). Southwest Lower Michigan experienced both damaging winds and large hail during the month, with winds as high as 76 mph and hail up to golf ball size being reported.

Table 3. Reported severe weather events and episodes across Southwest Lower Michigan. An episode is defined as three or more events within 6 hours.

Events (Sept. 2010)	51
Events (Sept. 2009)	0
Events (1986 – 2010 average)	10
Events (record)	51
year(s) of record	2010
Episodes (2010)	2
Episodes (2009)	0
Episodes (1986 – 2010 average)	1
Episodes (record)	3
year(s) of record	2001

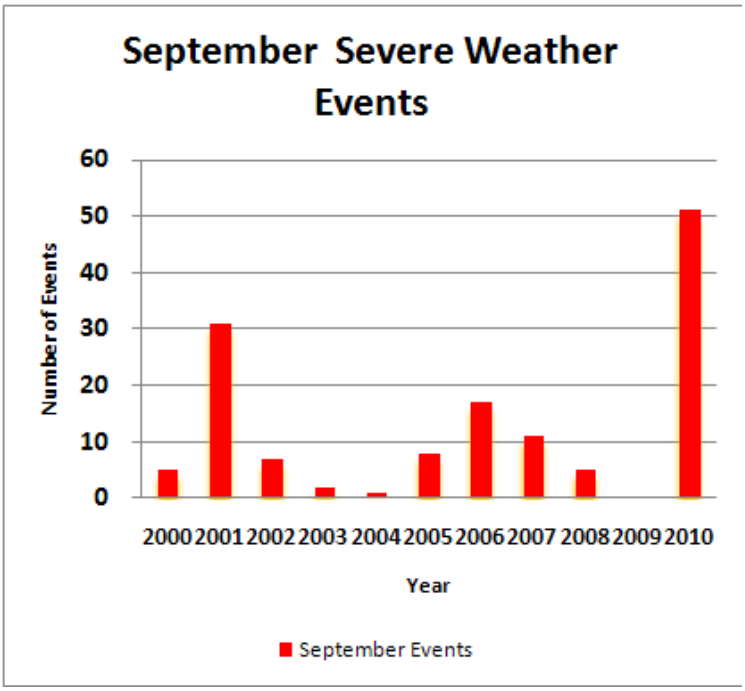

Figure 12. The total number of severe weather events from 2000 to 2010 across Southwest Lower Michigan.

September 2010 Climate Summary for Southwest Lower Michigan

Highlights of the month of September 2010

2nd – 3rd

Severe weather occurred late at night on the 2nd and early in the morning on the 3rd. A cold front triggered storms across the area that ended up producing strong wind gusts which took down some trees across some lakeshore communities as well as northern Kent County. These storms were also prolific rainfall producers, giving Muskegon a record rainfall of 3.34" on the 2nd.

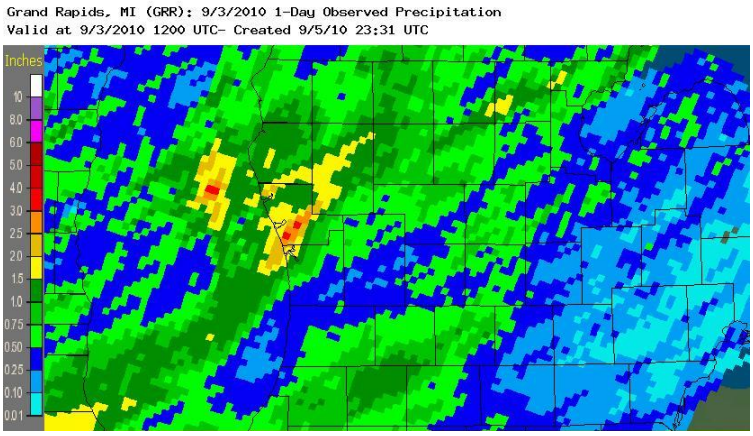

Figure 13. Total rainfall from 8 AM on September 2nd through 8 AM on September 3rd.

7th

Wind advisories were issued for the area after a strong cold front moved through during the morning hours. Winds generally gusted in the 40 to 50 mph range, including a 51 mph wind gust at Gerald R. Ford International Airport. Some power outages resulted from the strong winds.

16th

Afternoon downpours plagued portions of West Michigan including the greater Lansing area and caused localized urban flooding. Some roads and parking lots in downtown Lansing and East Lansing were flooded and waters rose up to the doors of some vehicles.

Figure 14. Flooding in East Lansing near MSU. Picture courtesy of Zack Schwarzkopf.

21st

A fairly significant late season severe weather event impacted the region. Storms well out ahead of a cold front during the afternoon hours produced hail up to golf ball size from Mecosta County to Isabella County. Later at night, a line of thunderstorms along the cold front produced damaging winds in the 65 to 75 mph range along the lakeshore in Muskegon, Ottawa, and Allegan counties. These severe winds moved inland across Kent and Ionia Counties. Localized tree damage was reported in association with these winds. Both Tulip City Airport in Holland and Gerald R. Ford International Airport in Grand Rapids recorded 72 mph wind gusts. At Grand Rapids, this was one of the highest wind gusts ever measured at the airport.

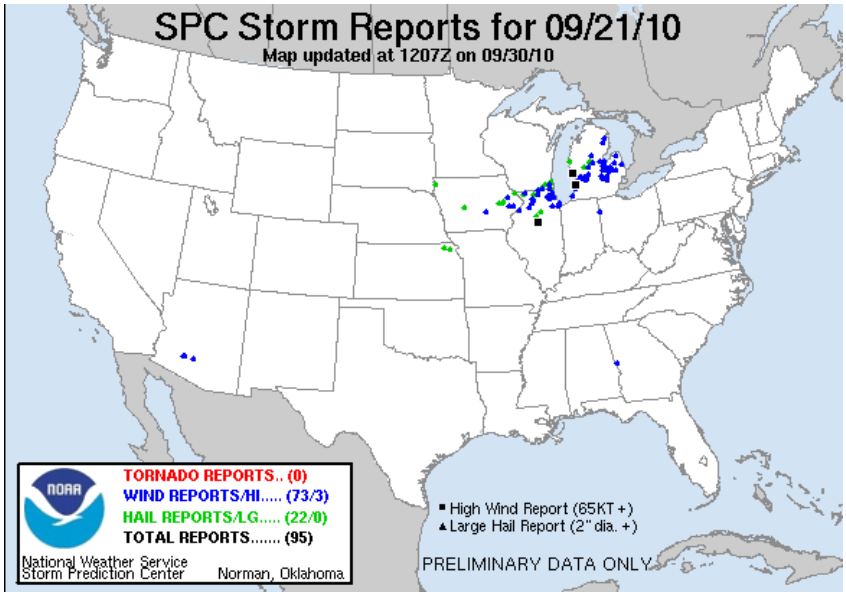

Figure 15. Severe weather reports from September 24. Note the two black squares along the lakeshore, indicating winds 65 kts (75 mph) or greater.

24th

Wind advisories were issued once again. A cold front swept through the area during the morning hours, with temperatures ahead of the cold front remarkably still in the upper 70s to near 80 for nighttime lows across the area! Peak wind gusts were very similar to the wind event on the 7th, with both Grand Rapids and Lansing reporting peak gusts of 51 mph.